

DESIGN NOTES:

Reference: AESI, Updated Geotechnical Report, Dated March 31, 2000  
Packland Site Plan, Sept. 1, 2015  
The following design assumptions were used:  
Internal angle of friction for reinforced soil = 32 degrees (design only - see Material Note "F")  
Unit weight of reinforced soil = 125 pcf  
Maximum wall height = 53.33 feet (Single), 24 feet (Tiered)  
Batter of wall = 1H : 10V  
Surcharge = 250 psf Surcharge and 2H : 1V Slope.

TECHNICAL SPECIFICATIONS FOR MECHANICALLY STABILIZED LOCK & LOAD RETAINING WALLS  
GENERAL:

- A. The work involves the supply and installation of soil reinforced retaining walls. The Concrete Panels and Counterforts will consist of Lock & Load Stone. Counterfort and Geogrid are the types of soil reinforcement. The work will include, but is not limited to:
- A-1 excavation to the grades shown on the civil drawings
  - A-2 supply and installation of geogrid reinforcement
  - A-3 supply and installation of drainage fill and piping
  - A-4 supply and installation of segmental Lock & Load Stones
  - A-5 supply and installation of retained and reinforced soil fill
- B. The walls shall be installed on undisturbed Native Soils or Structural Fill, as appropriate.

MATERIALS

- A. Concrete Panels and Counterforts are locked together to form a "Stone". The retaining walls have been designed on the basis of Lock & Load Retaining Wall "Stones". Stones are to be purchased from a licensed Lock & Load manufacturer. The Lock & Load trademark on each pallet identifies Lock & Load products.
- B. Information on the purchase of Lock & Load products can be obtained through:
- Lock & Load Retaining Walls Ltd.  
Tel. (604) 732-9990  
Website: www.lock-load.com
- C. Geogrid - See Geogrid Schedule.
- D. Face Gravel - 3/4" clean crushed rock. Substitution with comparable material is acceptable, upon approval of the Geotechnical Engineer.
- E. Reinforced and Retained Backfill - Suitable granular native material approved by the Geotechnical Engineer.
- F. Leveling Pad - The Leveling Pad shall consist of angular, crushed aggregate of maximum size of 3/4 inch. The Leveling Pad Fill may be single size or may be well graded containing a maximum of 5% passing the #200 sieve.

EXECUTION

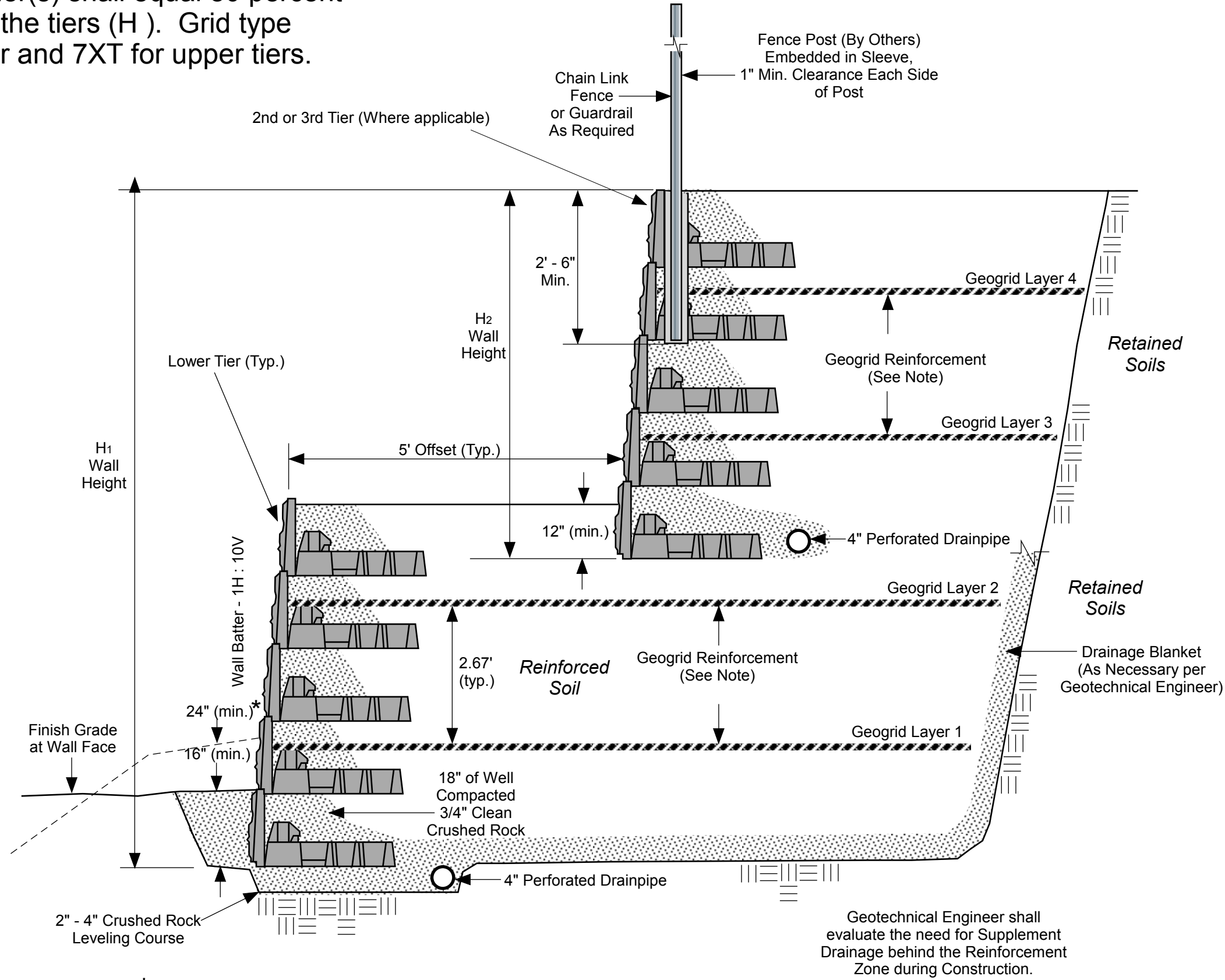
- A. Contractor shall excavate to the lines and grades shown on the construction drawings. The Geotechnical Engineer should observe the excavation prior to the placement of the leveling material or fill soils.
- B. Over-excavation of deleterious soils or rock shall be replaced with material meeting the specifications described in the section "Material F" above, and compacted to 95% of ASTM D-1557-91 (Modified Proctor) within 2% of the optimum moisture content of the soil.
- C. The first course of concrete Lock & Load Stones shall be placed on the Leveling Pad and the alignment and level checked.
- D. Stones shall be placed with the top of the panel level and parallel to the wall face. The Counterfort Base installs horizontal and perpendicular to the face of the retaining wall.
- E. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.
- F. Geogrid reinforcement shall be placed at the levels and to the lengths shown on the drawings beginning at the back of the Lock & Load Panels.
- G. The geogrid shall be laid horizontally in the direction perpendicular to the face of the retaining wall. The geogrid shall be pulled taut, free of wrinkles and anchored prior to backfill placement on the geogrid.
- H. The geogrid reinforcement shall be continuous throughout their embedment lengths. Spliced connection between shorter pieces of geogrid is not permitted.
- I. The drainage pipe discharge points shall be connected to approved discharge.
- J. Reinforced and Retained Backfill shall be placed, spread and compacted in such a manner that minimizes the development of slack in the geogrid.
- K. Reinforced and Retained Backfill shall be placed and compacted in lifts not to exceed 8 inches where hand compaction equipment is used and not more than 12 inches where heavy compaction equipment is used. FIRST - compact over tail of Counterfort then away from the retaining wall structure. Hand operated compaction equipment (700 lbs. to 1,000 lbs.) Vibratory Plate shall be used to compact face gravel at wall face.
- L. Reinforced and Retained Backfill shall be compacted to 95% of the maximum density as determined by ASTM D-1557-91 (Modified Proctor) or equivalent. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within 2 percentage points of the optimum moisture content.
- M. Hand-operated equipment (700 lbs. to 1,000 lbs. Vibratory Plate) shall be used within 26 inches of the front face of the concrete facing.
- N. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid.

- O. Rubber tired equipment may pass over the geogrid reinforcement at slow speeds less than 5 mph. Sudden braking and sharp turning shall be avoided.
- P. At the end of each day of operation, the contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from the wall face. The contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

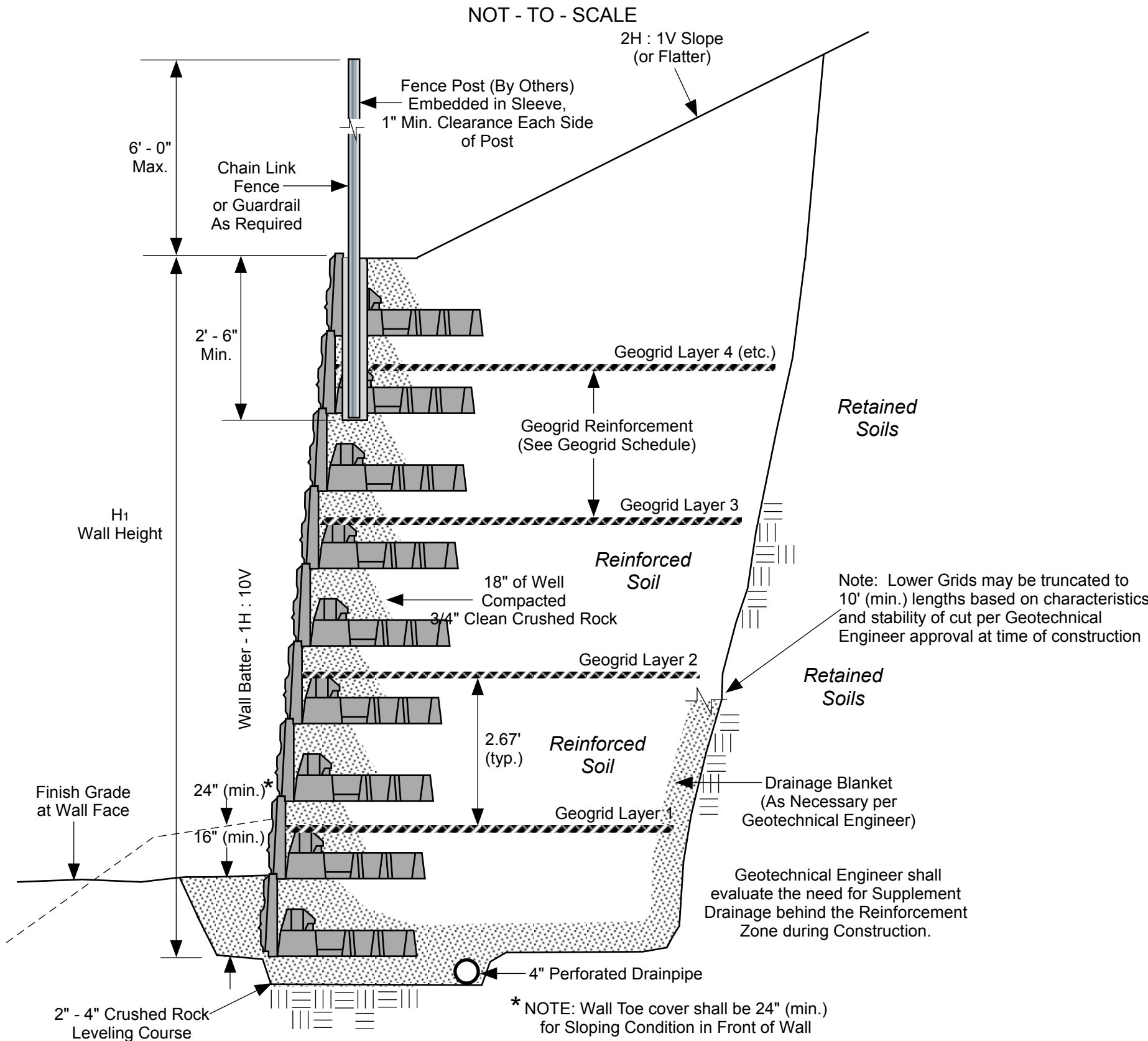
GEOGRID SCHEDULE																					
Wall Height (H <sub>1</sub> ft.)	Geogrid Length (L <sub>1</sub> ft.) *	Layers																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
5.33	5.00	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.67	6.00	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.00	7.00	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.33	8.00	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.67	9.00	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12.00	10.00	B	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13.33	11.00	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.67	12.00	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16.00	14.00	C	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17.33	16.00	C	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.67	17.00	C	B	A	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-
20	18.00	C	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-	-
21.33	19.00	C	C	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-
22.67	20.00	C	C	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-	-
24.0	21.00	C	C	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-
25.33	22.00	C	C	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-	-
26.67	23.00	C	C	C	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-
28.0	24.00	C	C	C	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-	-
29.33	25.00	C	C	C	B	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-
30.67	27.00	C	C	C	B	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-	-
32.0	28.00	C	C	C	C	B	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-
33.33	29.00	C	C	C	C	B	B	B	B	A	A	A	A	-	-	-	-	-	-	-	-
33.67	30.00	C	C	C	C	B	B	B	B	B	A	A	A	A	-	-	-	-	-	-	-
36.00	32.00	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-	-	-	-	-
37.33	33.00	E	D	C	C	C	C	C	B	B	A	A	A	A	A	-	-	-	-	-	-
38.67	34.00	E	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-	-	-	-
40.00	35.00	E	D	D	D	C	C	C	C	B	B	A	A	A	A	-	-	-	-	-	-
41.33	36.00	E	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-	-	-
42.67	37.00	E	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-	-	-
44	38.00	E	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-	-
45.33	39.00	E	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	A	-	-	-
46.67	40.00	E	D	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-	-
48	41.00	E	D	D	D	D	D	D	C	C	C	C	B	B	A	A	A	A	A	-	-
49.33	42.00	E	E	D	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-	-
50.67	43.00	E	E	D	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	A	-
52	44.00	E	E	E	D	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	-
53.33	45.00	E	E	E	D	D	D	D	D	C	C	C	C	C	B	B	A	A	A	A	A

GEOGRID: A = Miragrid 5XT  
B = Miragrid 7XT  
C = Miragrid 10XT  
D = Miragrid 20XT  
E = Miragrid 22XT

\*Note: For tiered wall condition, length of geogrid for bottom tier equals combined height of tiers (H ). Geogrid length for upper tier(s) shall equal 80 percent of the combined height of the tiers (H ). Grid type shall be 10XT for lower tier and 7XT for upper tiers.

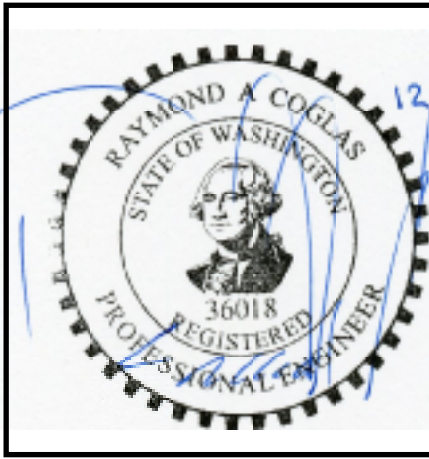


TIERED WALL SECTION \*



TYPICAL SINGLE WALL SECTION

NOT - TO - SCALE



Lock - Load Wall Design  
SOUNDVIEW TECHNOLOGY CENTER  
Everett, Washington

Earth Solutions NW LLC  
Geotechnical Engineering, Construction Monitoring  
and Environmental Sciences

Revisions			
Date	Revisions	By	Check
4/01/05			
12/13/2016		MRS	RAC

Sheet No.

W1



NOTES:

Rockery construction shall be performed in accordance with the Associated Rockery Contractor Guidelines.

Rockery construction is a craft. The skill and experience of the builder will largely dictate the success of the construction.

A rockery is a protective system with respect to the weathering and erosion process on an exposed soil face.

Maximum inclination of the slopes above and in front of rockeries should be 2 : 1 (horizontal : vertical).

Minimum thickness of rock filter layer = 18 inches.

Rockeries greater than 6 feet in height should be installed under the observation of the Geotechnical Engineer.

The long dimension of the rocks should extend back towards the cut or fill face to provide maximum stability.

Rocks should be placed to avoid continuous joint planes in vertical or lateral directions. Each rock should bear on two or more rocks below it, with good flat-to-flat contact.

Rock designations and approximate weights are provided below.

For Fill Rockeries, it is imperative that Structural Fill compaction extend all the way to the back of the Rockery and Filter Drain Rock Zone. Reduced lift thickness and light compaction equipment may be required to fully achieve the required compaction.

Size	Approximate Weight - lbs.	Approximate Diameter
1 Man	50 - 200	12" - 18"
2 Man	200 - 700	18" - 28"
3 Man	700 - 2000	28" - 36"
4 Man	2000 - 4000	36" - 48"
5 Man	4000 - 6000	48" - 54"
6 Man	6000 - 8000	54" - 60"

GEOGRID SOIL REINFORCEMENT

- A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 300. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking and stripping.
- B. Geogrid shall be Miragrid 7XT for rockeries 16' or less.
- C. Manufacturing Quality Control:  
The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.  
The QC testing shall include:  
...Tensile Strength Testing  
...Melt Flow Index (HDPE)  
...Molecular Weight (Polyester)

STRUCTURAL FILL

- A. Structural Fill shall consist of granular well graded material with a fines content of less than 25 percent (percent passing the #200 sieve based on the minus three-quarters inch fraction). Some rockery applications may require the use of "select" free draining Structural Fill Material. Structural Fill Material shall be approved and tested by the Geotechnical Engineer.

STRUCTURAL GEOGRID INSTALLATION

- A. Geogrid shall be oriented with the highest strength axis perpendicular to the rockery alignment.
- B. Geogrid Reinforcement shall be placed at the strengths, lengths and elevations shown on the construction design drawings or as directed by the Engineer.
- C. The geogrid shall be laid horizontally on compacted backfill and extend to the back of the rockery. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.
- D. Geogrid Reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrids are not permitted.

REINFORCED BACKFILL PLACEMENT

- A. Reinforced Backfill shall be placed, spread and compacted in such a manner that minimizes the development of slack in the geogrid and installation damage.
- B. Reinforced Backfill shall be placed and compacted in lifts not to exceed 6 inches where hand compaction is used, or 8 - 10 inches where heavy compaction equipment is used. Lift thickness shall be decreased to achieve the required density as required.
- C. Reinforced Backfill shall be compacted to 95% of the maximum density as determined by ASTM D-1557-91. The moisture content of the backfill material prior to and during compaction shall be at or near the optimum moisture content.
- D. The required compaction shall extend all the way to the back of the Rockery and Filter Drain Rock Zone.

- E. Only lightweight hand-operated equipemnt shall be allowed within 3 feet of the back of the rockery.
- F. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.
- G. Rubber tired equipment may pass over geogrid reinforcement at slow speed, less than 10 MPH. Sudden braking and sharp turning shall be avoided.
- H. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the rockery to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

NATIVE CUT ROCKERY

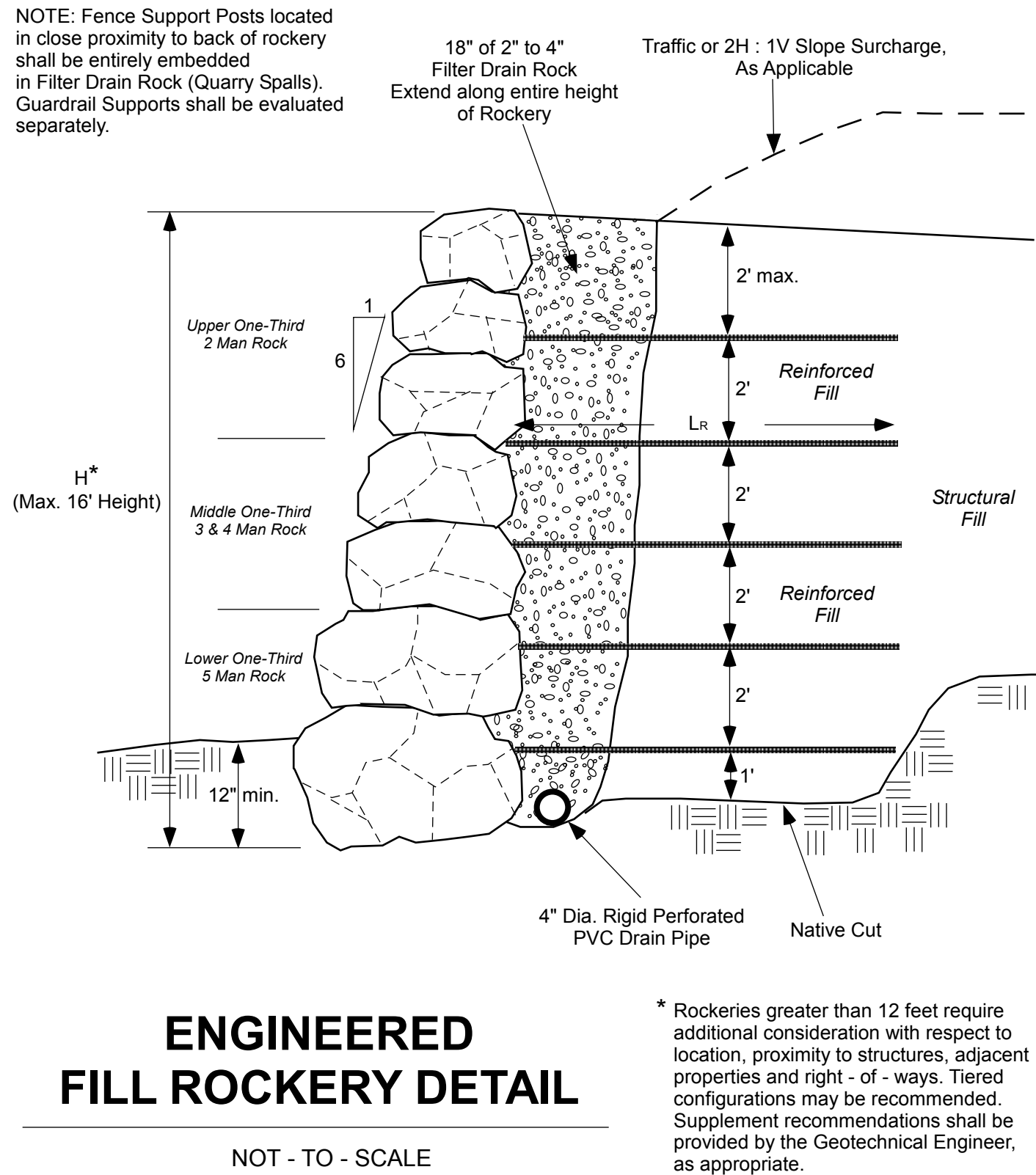
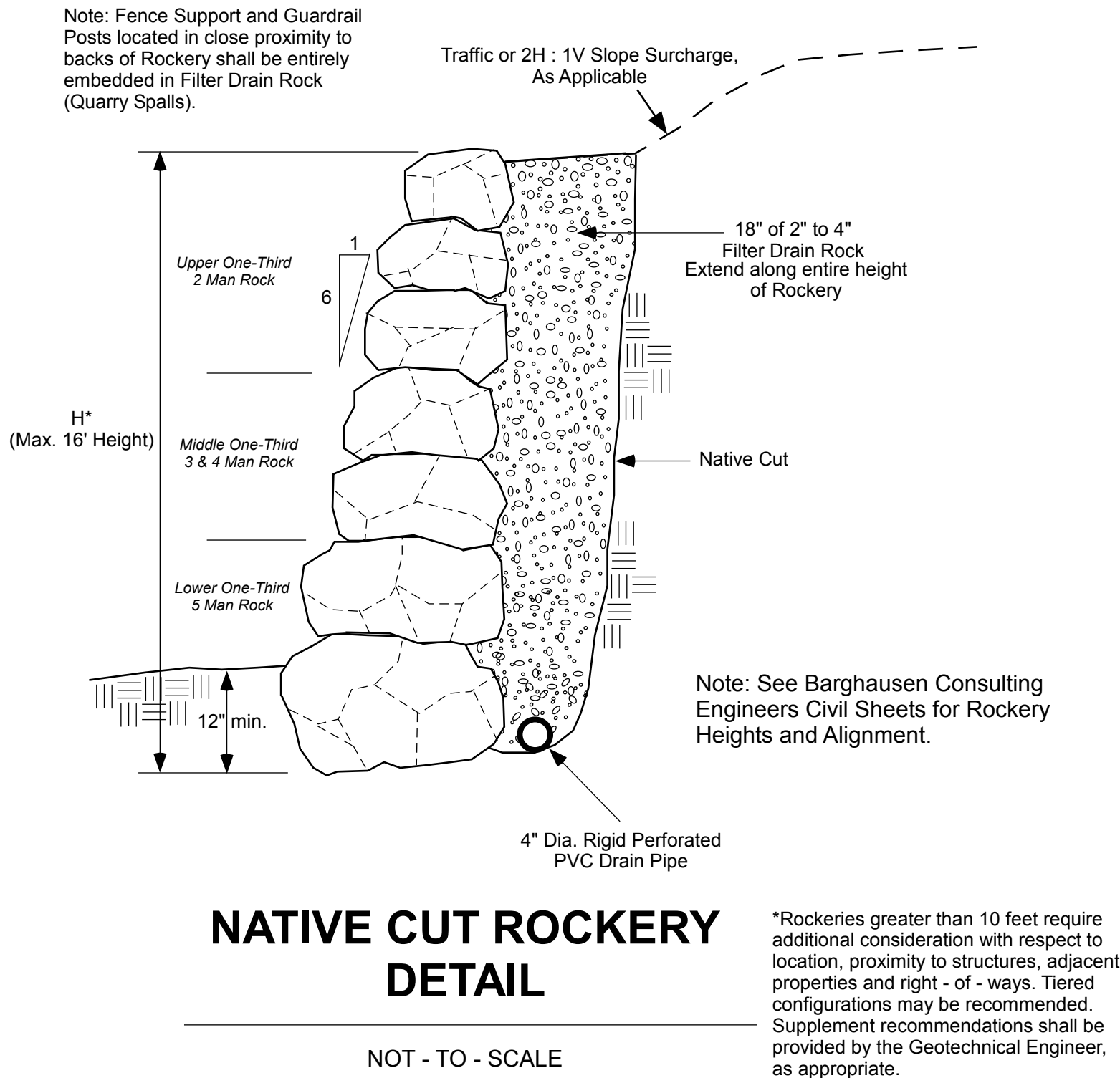
- A. The Geotechnical Engineer shall observe cuts for the rockery. Additional flattening of cuts may be recommended by the Geotechnical Engineer depending on the soil and groundwater conditions observed. Where Native Cuts do not expose competent Native Soils, additional excavation and the addition of reinforcement and Compacted Structural Fill may be necessary.

FIELD QUALITY CONTROL

- A. The rockery construction shall be observed by the Geotechnical Engineer on a periodic or full-time basis as appropriate. Testing of the compacted backfill shall be performed by the Geotechnical Engineer.
- B. Quality assurance shall include foundation soil inspection, soil and backfill testing, verification of design parameters and observation of construction for general compliance with design drawings and specifications.

REINFORCEMENT SCHEDULE	
Wall Height (feet) H	Length of Reinforcing (feet)* LR
4.0	4.0
6.0	6.0
8.0	8.0
10.0	10.0
12.0	12.0
14.0	14.0
16.0	16.0

\* Geogrid Miragrid 7XT



Date	Revisions

4011.05	12/13/2016	MRS	RAC
Proj. No.	Date	Drawn By	Checked By

Sheet No.

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